US Army Corps
of Engineers®

Nashville District

PROPOSED
Mitigation Guidelines for the Nashville District Regulatory Program

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PREFACE

The US Army Corps of Engineers (USACE) and the US Environmental Protection Agency (EPA) regulations (33 CFR 320-330 and 40 CFR 230) authorize USACE to require compensatory mitigation for unavoidable impacts to wetlands and other jurisdictional waters of the US. USACE is aware of problems with past compensatory mitigation and is committed to improving the success of future compensatory mitigation projects. These Mitigation Guidelines and Monitoring Requirements are designed to assist the regulated public with all aspects of the mitigation process and to provide information to ensure future compensatory mitigation with regulated impacts to waters of the US. The guidelines, developed from previous guidelines, experience, field investigations, and public input, provide the next steps in the process of improving the success of compensatory mitigation projects in the Nashville District.

Under Section 404 of the Clean Water Act (CWA), the Nashville District regulates the discharge of dredged and fill material into waters of the US, including wetlands. As a result, Department of the Army (DA) authorization is normally required to conduct such ground disturbing activities as filling, grading, mechanized land clearing, and excavation that results in more than incidental fallback of dredged material if they occur in waters of the US. When the USACE reviews a project that would require DA authorization, its evaluation typically includes a determination of whether the applicant has taken sufficient measures to mitigate the project's likely adverse impact on the aquatic ecosystem. The District Engineer will normally require the implementation of all appropriate and practicable compensation as a condition of the DA authorization.

Before compensatory mitigation is considered, appropriate and practicable measures to avoid and minimize those adverse impacts to the aquatic ecosystem that are not necessary or cannot reasonably be avoided must be taken.

I. Compensatory Mitigation

Once avoidance and minimization have been considered, applicants must implement appropriate and practicable measures to compensate for adverse project impacts to the aquatic ecosystem.

While this sequential process (avoid, minimize, compensate) is normally applied only during the individual permit process, most nationwide and regional general permits require that discharges of dredged or fill material into waters of the US be avoided and minimized to the maximum extent practicable, unless the District Engineer approves a compensatory mitigation plan that is more beneficial to the environment than minimization or avoidance measures that could be undertaken at the project site.

The purpose of compensatory mitigation is to replace those aquatic ecosystem functions that would be lost or impaired as a result of a USACE-authorized activity. The type and amount of compensatory mitigation required will be commensurate with the nature and extent of the activity's adverse impact on aquatic functions and practicable in terms of cost, existing technology, and logistics, in light of the overall project purpose. Aquatic functions, which are most simply defined as "the things that aquatic systems do," include sediment trapping and nutrient removal; erosion control; provision of habitat for fish and wildlife, including endangered species; flood storage and conveyance; groundwater recharge; water supply; production of food, fiber, and timber; and recreation. The number and extent of aquatic functions performed by the myriad aquatic sites found across the Nashville District varies considerably.

Compensatory mitigation may include the restoration, enhancement, creation, and/or preservation of wetlands and other aquatic resources.

Restoration is the manipulation of the physical, chemical, or biological characteristics of a former or substantially degraded wetland, or other aquatic resource to return natural and/or historic functions; **Enhancement** is the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific function or functions or to change the growth stage of composition of the vegetation present, and may include converting the site to a less destructive land use; **Creation** is the establishment of a wetland or other aquatic resource where one did not formerly exist; and **Preservation** is the legal and physical protection of existing ecologically important wetlands and other aquatic resources for an extended period of time, usually in perpetuity. .

Restoration and enhancement are generally preferred to creation because these actions are normally less expensive to implement, less prone to failure, and less likely to adversely affect existing valuable upland habitats. Compensatory mitigation that would involve ground-disturbing activities in waters of the United States may itself require DA authorization.

It is important to remember that the primary goal of compensatory mitigation is to replace those aquatic functions that would be lost or impaired as a result of the proposed activity. That is, compensation should generally be "in-kind." Compensatory mitigation should also replace aquatic functions as close to the site of the adverse impact as practicable in order to minimize losses to the local aquatic system. However, out-of- kind and/or off-site compensation may be appropriate when compensation either cannot reasonably be conducted in kind and/or at the impact site or would be more beneficial to the aquatic ecosystem if conducted out-of-kind or at another location. In some cases, it may be acceptable to provide partial compensation at multiple locations. For example, compensation for lost flood storage and sediment-trapping functions might be required on-site while compensation for lost wildlife habitat might be allowed at another location.

Compensatory mitigation is normally implemented by taking one of two general approaches: project specific mitigation or third-party mitigation. Project-specific mitigation is conducted to compensate for the adverse impacts of a single activity requiring DA authorization. It is typically designed and implemented by the permittee in conjunction with the authorized activity. The permittee is responsible for monitoring and assuring the success of the project-specific mitigation. Third-party mitigation typically consolidates the compensatory mitigation for several projects requiring DA authorization into one or more off-site mitigation projects. This approach is distinguished from project-specific mitigation in that a third party typically accepts the responsibility of designing, implementing, and assuring the success of compensatory mitigation for the permittees. This approach includes mitigation banking and in-lieu fee mitigation. A brief description of each follows:

Mitigation banking: Mitigation systems that provide consolidated off-site compensation for the adverse impacts of numerous authorized activities in advance of those impacts. A mitigation bank is developed and operated pursuant to the provisions of a mitigation banking instrument that are mutually agreed to by the bank owner, the USACE, and other natural resource agencies. In most cases, DA authorization is also required to develop the bank. For further information on mitigation banking, refer to "Federal Guidance for the Establishment, Use and Operation of Mitigation Banks," published in the Federal Register on November 28, 1995 (Vol. 60, No. 228, pp. 58605-58614).

In-lieu fee: Mitigation systems that provide a DA permittee an opportunity to pay a fee in lieu of conducting project-specific mitigation. Fees are then used to fund projects that are designed to restore, enhance, create, or, in some cases, preserve aquatic ecosystem functions. These projects should reflect both the nature and extent of the aquatic functions that are adversely affected by USACE-authorized activities. With an in-lieu fee system, specific mitigation projects that would be funded by in-lieu fees may not yet have been identified at the time the in-lieu fees are paid. For further information on in-lieu fee mitigation, refer to "Federal Guidance on the Use of In-Lieu-Fee Arrangements for Compensatory Mitigation under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act" dated October 31, 2000, and published in the Federal Register on November 7, 2000 (Vol. 65, No. 216).

II. National Research Council's Guidelines

In its comprehensive report entitled *"Compensating for Wetland Losses Under the Clean Water Act,"* the National Research Council (NRC) provided ten guidelines to aid in planning and implementing successful mitigation projects ("Operational Guidelines for Creating or Restoring Wetlands that are Ecologically Self-Sustaining"; NRC, 2001). Please note that these guidelines also pertain to restoration and enhancement of other aquatic resource systems, such as streams. Each of the ten guidelines can generally be described as A) basic requirement for mitigation success, or B) guide for mitigation site selection. The following sections include both the original text of the NRC guidelines, in italics, as well as a discussion of how to incorporate these guidelines into the development and review of mitigation projects.

A. Basic Requirements for Success

When considering mitigation sites, it is important to note that wetland mitigation is not a precise, exact science and predictable results are not always obtainable. Having an adaptive management attitude is a necessity. One should incorporate experimentation into the mitigation plan when possible. This may mean using experimental plots within a mitigation site with different controls, replication, different treatments and finally adjusting to intermediate results with an adaptive attitude and additional modifications to obtain long range wetland and watershed goals. In addition, researchers have found that restoration is the most likely type of mitigation to result in successful and sustainable aquatic resource replacement. Moreover, numerous studies in a variety of landscapes and watershed types have shown that of all factors contributing to mitigation success, attaining and maintaining appropriate hydrological conditions is the most important. The following NRC guidelines should be considered basic requirements for mitigation success.

A.1. **Whenever possible, choose wetland restoration over creation**. *Select sites where wetlands previously existed or where nearby wetlands still exist. Restoration of wetlands has been observed to be more feasible and sustainable than creation of wetlands. In restored sites the proper substrate may be present, seed sources may be on-site or nearby, and the appropriate hydrological conditions may exist or may be more easily restored.*

The USACE and EPA Mitigation Memorandum of Agreement states that, "because the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, restoration should be the first option considered" (Fed. Regist. 60(Nov. 28):58605). The Florida Department of Environmental Regulation (FDER 1991a) recommends an emphasis on restoration first, then enhancement, and, finally, creation as a last resort. Morgan and Roberts (1999) recommend encouraging the use of more restoration and less creation.

The applicant proposes the type of mitigation. However, the USACE and other agencies will evaluate proposals based on the ease of completion and the likelihood of success. Therefore, pure wetland creation will be evaluated using very stringent criteria before being approved for use as compensatory mitigation for project impacts. Some projects may include creation as part of an overall mitigation effort that involves restoration, enhancement, and/or preservation (e.g., as in a proposed mitigation bank). In these cases, evaluation will be based on the entire proposal and its location in the watershed.

A.2. **Avoid over-engineered structures in the wetland's design.** *Design the system for minimal maintenance. Set initial conditions and let the system develop. Natural systems should be planned to accommodate biological systems. The system of plants, animals, microbes, substrate, and water flows should be developed for self-maintenance and self-design. Whenever possible, avoid manipulating wetland processes using approaches that require continual maintenance. Avoid hydraulic control structures and other engineered structures that are vulnerable to chronic failure and require maintenance and replacement. If necessary to design in structures, such as to prevent erosion until the wetland has developed soil stability, do so using natural features, such as large woody debris. Be aware that more specific habitat designs and planting will be required where rare and endangered species* are *among the specific restoration targets.*

Whenever feasible, use natural recruitment sources for more resilient vegetation establishment. Some systems, especially estuarine wetlands, are rapidly colonized, and natural recruitment is often equivalent or superior to plantings (Dawe et al. 2000). Try to take advantage of native seed banks, and use soil and plant material salvage whenever possible. Consider planting mature plants as supplemental rather than required, with the decision depending on early results from natural recruitment and invasive species occurrence. Evaluate on-site and nearby seed banks to ascertain their viability and response to hydrological conditions. When plant introduction is necessary to promote soil stability and prevent invasive species, the vegetation selected must be appropriate to the *site rather than forced to fit external pressures for an ancillary purpose (e.g., preferred wildlife food source or habitat).*

The use of over-engineered structures and maintenance intensive plans for mitigation is not recommended and will be evaluated using very stringent criteria. If these types of plans are ultimately approved, they must include a comprehensive remedial plan and financial assurances [note that all mitigation projects should have remedial plans and financial assurances], along with a non-wasting endowment to insure that proper maintenance occurs.

It should also be noted that aggressive soil and planting plans using introduced plants and soil from outside sources must be closely monitored to prevent invasive plant takeovers and monotypic plant communities. Such failures can be minimized by undertaking both short-term and long-term monitoring, and having contingency plans in place.

A. 3. **Restore or develop naturally variable hydrological conditions**. *Promote naturally variable hydrology, with emphasis on enabling fluctuations in water flow and level, and duration and frequency of change, representative of other comparable wetlands in the same landscape setting. Preferably, natural hydrology should be allowed to become reestablished rather than finessed through active engineering devices to mimic a natural hydroperiod. When restoration is not an option, favor the use of passive devices that have a higher likelihood to sustain the desired hydroperiod over long term. Try to avoid designing a system dependent on water-control structures or other artificial infrastructure that must be maintained in perpetuity in order for wetland hydrology to meet the specified design. In situations where direct (in-kind) replacement is desired, candidate mitigation sites should have the same basic hydrological attributes as the impacted site*.

Hydrology should be inspected during flood seasons and heavy rains, and the annual and extreme-event flooding histories of the site should be reviewed as closely as possible. For larger mitigation projects, a detailed hydrological study of the site should be undertaken, including a determination of the potential interaction of groundwater with the proposed wetland. Without flooding or saturated soils, for at least part of the growing season, a wetland will not develop. Similarly, a site that is too wet will not support the desired biodiversity. The tidal cycle and stages are important to the hydrology of coastal wetlands.

Natural hydrology is the most important factor in the development of successful mitigation. Wetlands and other waters are very dynamic, and dependent on natural seasonal and yearly variations that are unlikely to be sustainable in a controlled hydrologic environment. Artificial structures and mechanisms should be used only temporarily. Complex engineering and solely artificial mechanisms to maintain water flow normally will not be acceptable in a mitigation proposal. In those sites where an artificial water source (irrigation) has been used to attempt to simulate natural hydrology there are several problems that lead to reduced likelihood of success. First, artificial irrigation does not provide the dynamic and variable nature of water flow normally found in wetlands or riparian systems. Second, the lack of seasonal flows limits the transport of organic matter into and out of the wetland or riparian system. Without any inflow, the net result of artificial irrigation is transport of organic material out of the system. Third, depending on the timing, the use of flood or sprinkler systems on newly created or restoration sites often promotes the germination and growth of exotic plant species.

Note that this changes USACE's past policy of accepting artificial irrigation as the sole source of hydrology for mitigation projects. If permitted at all, these projects will require substantial financial assurances and a higher mitigation ratio to offset their risk of failure. Applicants must weigh the potential investment costs of acquiring land suitable for restoration versus creation projects in upland environments that will likely involve higher long-term costs and greater risks of mitigation site failure.

The USACE may approve exceptions dealing with hydrologic manipulations, on a case-by-case basis in highly unusual circumstances. It should be noted, however, that even minor engineering or hydraulic manipulation requiring long-term maintenance will only be approved after the applicant posts a non-wasting endowment, performance bond, or other financial assurance.

A.4. **Consider complications associated with creation or restoration in seriously degraded or disturbed sites.** *A seriously degraded wetland, surrounded by an extensively developed landscape, may achieve its maximal function only as an impaired system that requires active management to support natural processes and native species (NRC 1992). It should be recognized, however, that the functional performance of some degraded sites may be optimized by mitigation, and these considerations should be included if the goal of the mitigation is water- or sediment-quality improvement, promotion of rare or endangered species, or other objectives best served by locating a wetland in a disturbed landscape position. Disturbance that is intense, unnatural, or rare can promote extensive invasion by exotic species or at least delay the natural rates of redevelopment. Reintroducing natural hydrology with minimal excavation of soils often promotes alternative pathways of wetland development. It is often advantageous to preserve the integrity of native soils and to avoid deep grading of substrates that may destroy natural belowground processes and facilitate exotic species colonization (Zedler 1996).*

When considering restoration options it is necessary to determine the spatial and temporal scale of the damage: is the damage limited to the water body itself, or is it a predominant characteristic of the watershed or the surrounding landscape? On-site damage may be restorable, whereas regional-scale damage may be more difficult, or impossible, to reverse or obtain historic conditions. Alternate goals may be necessary in order to determine specific goals of the restoration project. Those desired wetland mitigation goals will depend on the resources needed, the level of degradation and realistic mitigation targets as reflected by the watershed and surrounding landscape. This issue points to the importance of evaluating mitigation plans from a broader watershed perspective.

A.5. **Conduct early monitoring as part of adaptive management**. *Develop a thorough monitoring plan as part of an adaptive management program that provides early indication of potential problems and direction for correction actions. The monitoring of wetland structure, processes, and function from the onset of wetland restoration or creation can indicate potential problems. Process monitoring (e.g., water-level fluctuations, sediment accretion and erosion, plant flowering, and bird nesting) is particularly important because it will likely identify the source of a problem and how it can be remedied. Monitoring and control of nonindigenous* *species should be a part of any effective adaptive management program. Assessment of wetland performance must be integrated with adaptive management. Both require understanding the processes that drive the structure and characteristics of a developing wetland. Simply documenting the structure (vegetation, sediments, fauna, and nutrients) will not provide the knowledge and guidance required to make adaptive "corrections" when adverse conditions are discovered. Although wetland development may take years to decades, process-based monitoring might provide more sensitive early indicators of whether a mitigation site is proceeding along an appropriate trajectory.*

There are many factors that may positively or negatively influence aquatic resources and the functions they provide, such as urbanization, farming or grazing. Wetlands and other aquatic resources are often subject to a wide range and frequency of events such as floods, fires and ice storms. As with all natural systems, some things are beyond control. Well-crafted mitigation plans, however, recognize the likelihood of these events and attempt to plan for them, primarily through monitoring and adaptive management. In addition, it is important to realize the mobile nature of wetlands and streams. They change over time and over the landscape in response to internal and external forces.

Monitoring and adaptive management should be used to evaluate and adjust maintenance (e.g., predator control, irrigation), and design remedial actions. Adaptive management should consider changes in ecological patterns and processes, including biodiversity of the mitigation project as it evolves or goes through successional stages. Trends in the surrounding area must also be taken into account (i.e., landscape/watershed context). Being proactive helps ensure the ultimate success of the mitigation, and improvement of the greater landscape. One proactive methodology is incorporation of experimentation into the mitigation plan when possible, such as using experimental plots within a mitigation site with different controls, replication, different treatments, inputs, etc., to determine if specific mitigation efforts are meeting the desired goals.

B. Mitigation Site Selection

The selection of an appropriate site to construct a mitigation project is one of the most important, yet often under-evaluated, aspects of mitigation planning. In many instances, the choice of the mitigation site has been completed by the applicant based solely on economic considerations with minimal concern for the underlying physical and ecological characteristics of the site. While economic factors are important in determining the practicability of site selection, current technology and the following NRC guidelines should also factor into the selection of a mitigation site.

B.1. **Consider the hydrogeomorphic and ecological landscape and climate.** *Whenever possible, locate the mitigation site in a setting of comparable landscape position and hydrogeomorphic class. Do not generate atypical "hydrogeomorphic hybrids"; instead, duplicate the features of reference wetlands or enhance connectivity with natural upland landscape elements (Gwin et al. 1999).*

Regulatory agency personnel should provide a landscape setting characterization of both the wetland to be developed and, using comparable descriptors, the proposed mitigation site. Consider conducting *a cumulative impact analysis at the landscape level based on templates for wetland development (Bedford 1999). Landscapes have natural patterns that maximize the value and function of individual habitats. For example, isolated wetlands function in ways that are quite different from wetlands adjacent to rivers. A forested wetland island, created in an otherwise grassy or agricultural landscape, will support species that are different from those in a forested wetland in a large forest tract. For wildlife and fisheries enhancement, determine if the wetland site is along ecological corridors such as migratory flyways or spawning runs. Constraints also include landscape factors. Shoreline and coastal wetlands adjacent to heavy wave action have historically high erosion rates or highly erodible soils, and often-heavy boat wakes. Placement of wetlands in these locations may require shoreline armoring and other protective engineered structures that are contrary to the mitigation goals and at cross-purposes to the desired functions.*

Even though catastrophic events cannot be prevented, a fundamental factor in mitigation plan design should be how well the site will respond to natural disturbances that are likely to occur. Floods, droughts, muskrats, geese, and storms are expected natural disturbances and should be accommodated in mitigation designs rather than feared. Natural ecosystems generally recover rapidly from natural disturbances to which they are adapted. The design should aim to restore a series of natural processes at the mitigation sites to ensure that resilience will have been achieved.

Watershed management requires thinking in terms of multiple spatial scales: the specific wetland or stream itself, the watershed that influences the wetland/stream, and the greater landscape. The landscape in which a wetland or water exists, defines its hydrogeologic setting. The hydrogeologic setting in turn controls surface and sub-surface flows of water, while a variety of hydrogeologic settings results in biological and functional diversity of aquatic resources.

There are three aspects of watershed management that the applicant must address in a mitigation plan: hydrogeomorphic considerations, the ecological landscape, and climate. It should be noted that the overall goal of compensatory mitigation is to replace the functions being lost (functional equivalency) due to a permitted Section 404 activity. By evaluating the hydrogeomorphic setting, ecological landscape and climate, one can determine which attributes can be manipulated (i.e. hydrology, topography, soil, vegetation or fauna) to restore, create or enhance viable aquatic functions.

Hydrogeomorphic considerations refer to the source of water and the geomorphic setting of the area. For example, a riverine wetland receives water from upstream sources in a linear manner, whereas vernal pools exist as relatively closed depressions underlain by an impermeable layer that allows rainfall runoff from a small watershed to fill the pool during specific times of year. Applicants should strive to replicate the hydrogeomorphic regime of the impacted water to increase the potential that the mitigation site mimics the functions lost. Only as a last resort, should applicants prepare plans for constructing wetlands using artificial water sources or placing wetlands into non-appropriate areas of the landscape. In such cases, there should be a contingency plan to prepare for unanticipated events or failures.

Ecological landscape describes the location and setting of the wetland/water in the surrounding landscape. For example, attempting to place mitigation in a dissimilar ecological complex than that of the impacted water is expected to result in a wetland/water unlikely to replicate the functions of the wetland/water that was lost. In all cases, the applicant should evaluate the historical ecological landscape of the mitigation site; for example, if there had been large areas of forested wetland in an agricultural area, then replacement of a forested wetland may be appropriate given other factors that should be considered. In most cases, applicants should plan for a mitigation area that fits best within the ecological landscape of the watershed or region of the mitigation site. Applicants should also consider constructing mitigation sites with more than one type of wetland/water regime, if appropriate, to provide for landscape diversity.

Climate also affects mitigation and is clearly beyond the control of the applicant. Therefore, the mitigation site should be sited in an area supported by the normal rainfall, subsurface and/or groundwater in the region. Climate considerations also can impact other hydrologic issues, sediment transport factors and other factors affecting attainment of desired functions. While climate cannot be manipulated, applicants need to account for it in mitigation plans, including local and regional variability and extremes.

B. 2. **Adopt a dynamic landscape perspective.** *Consider both current and future watershed hydrology and wetland location. Take into account surrounding land use and future plans for the land. Select sites that are, and will continue to be, resistant to disturbance from the surrounding landscape, such as preserving large buffers and connectivity to other wetlands. Build on existing wetland and upland systems. If possible, locate the mitigation site to take advantage of refuges, buffers, green spaces, and other preserved elements of the landscape. Design a system that utilizes natural processes and energies, such as the potential energy of streams as natural subsidies to the system. Flooding rivers and tides transport great quantities of water, nutrients, and organic matter in relatively short time periods, subsidizing the wetlands open to these flows as well as the adjacent rivers, lakes, and estuaries.*

Applicants should consider both current and expected future hydrology (including effects of any proposed manipulations), sediment transport, locations of water resources, and overall watershed functional goals before choosing a mitigation site. This is extremely critical in watersheds that are rapidly urbanizing; changing infiltration rates can modify runoff profiles substantially, with associated changes in sediment transport, flooding frequency, and water quality. More importantly, this factor encourages applicants to plan for long-term survival by placing mitigation in areas that will remain as open space and not be severely impacted by clearly predictable development. Consideration of the landscape perspective requires evaluation of buffers and connectivity (both hydrologic- and habitat-related). Buffers are particularly important to insure that changing conditions are ameliorated, especially in watersheds that have been, or are in the process of being, heavily developed. In addition, because wetlands are so dynamic, adequate buffers and open space upland areas are vital to allowing for wetlands to "breath" (expand and/or decrease in size and function) and migrate within the landscape, particularly in watersheds under natural and/or man-made pressures.

B.3. **Pay attention to subsurface conditions, including soil and sediment geochemistry and physics, groundwater quantity and quality, and infaunal communities**. *Inspect and characterize the soils in some detail to determine their permeability, texture, and stratigraphy. Highly permeable soils are not likely to support a wetland unless water inflow rates or water tables are high. Characterize the general chemical structure and variability of soils, surface* *water, groundwater, and tides. Even if the wetland is being created or restored primarily for wildlife enhancement, chemicals in the soil and water may be significant, either for wetland productivity or bioaccumulation of toxic materials. At a minimum, these should include chemical attributes that control critical geochemical or biological processes, such as pH, redox, nutrients (nitrogen and phosphorus species), organic content and suspended matter.*

Knowledge of the physical and chemical properties of the soil and water at the mitigation site is also critical to choice of location. For example, to mitigate for a saline wetland, without knowing the properties of the soil and water sources at the mitigation site, it is unlikely that such a wetland is restorable or creatable. Certain plants are capable of tolerating some chemicals and actually thrive in those environments, while others plants have low tolerances and quickly diminish when subjected to water containing certain chemicals, promoting monotypic plant communities. Planning for outside influences that may negatively affect the mitigation project can make a big difference as to the success of the mitigation efforts and meeting watershed objectives.

B.4 **Pay particular attention to appropriate planting elevation, depth, soil type, and seasonal timing.** *When the introduction of species is necessary, select appropriate genotypes. Genetic differences within species can affect wetland restoration outcomes, as found by Seliskar (1995), who planted cordgrass (<u>Spartina alterniflora</u>) from Georgia, Delaware, and Massachusetts into a tidal wetland restoration site in Delaware. Different genotypes displayed differences in stem density, stem height, belowground biomass, rooting depth, decomposition rate, and carbohydrate allocation. Beneath the plantings, there were differences in edaphic chlorophyll and invertebrates.*

Many sites are deemed compliant once the vegetation community becomes established. If a site is still being irrigated or recently stopped being irrigated, the vegetation might not survive. In other cases, plants that are dependent on surface-water input might not have developed deep root systems. When the surface-water input is stopped, the plants decline and eventually die, leaving the mitigation site in poor condition after the USACE has certified the project as compliant.

A successful mitigation plan needs to consider soil type and source, base elevation and water depth, plant adaptability and tolerances, and the timing of water input. When possible: a) use local plant stock already genetically adapted to the local environment; b) use stock known to be generally free from invasive or non-native species; c) use soil banks predetermined to have desirable seed sources; d) choose soil with desirable characteristics (e.g., high clay composition and low silt and sand composition for compaction purposes); e) determine \final bottom elevations to insure that targeted water regimes are met and the planned plant community can tolerate the water depth, frequency of inundation and quality of water sources.

It is particularly helpful to examine reference wetlands and/or waters near the mitigation area, in order to identify typical characteristics of sustainable waters in a particular watershed or region. This allows one to determine the likelihood of certain attributes developing in a proposed mitigation site. It should be emphasized that wetland restoration is much more likely to achieve desired results than wetland creation, as evidence of a previously existing wetland or other aquatic resource is a strong indicator of what will return, given the proper circumstances Historical data for a particular site, if available, can also help establish management goals and monitoring objectives. Creating wetlands from uplands has proven to be difficult and often requires extensive maintenance.

B.5. **Provide appropriately heterogeneous topography.** *The need to promote specific hydroperiods to support specific wetland plants and animals means that appropriate elevations and topographic variations must be present in restoration and creation sites. Slight differences in topography (e.g., micro- and meso-scale variations and presence and absence of drainage connections) can alter the timing, frequency, amplitude, and duration of inundation. In the case of some less-studied, restored wetland types, there is little scientific or technical information on natural microtopography (e.g., what causes strings and flarks in patterned fens or how hummocks in fens control local nutrient dynamics and species assemblages and subsurface hydrology are poorly known). In all cases, but especially those with minimal scientific and technical background, the proposed development wetland or appropriate example(s) of the target wetland type should provide a model template for incorporating microtopography. Plan for elevations that are appropriate to plant and animal communities that are reflected in adjacent or close-by natural systems. In tidal systems, be aware of local variations in tidal flooding regime (e.g., due to freshwater flow and local controls on circulation) that might affect flooding duration and frequency.*

While manipulations of natural water supply may not be possible or desirable, changes in topography are possible and should be incorporated in the design of a restored or created wetland/water when needed. Varying the depths of the substrate of the mitigation area ensures a heterogeneous topography, decreasing the likelihood of homogenous plant communities. Rather than plan on one water level or one elevation of the substrate, in hopes of establishing a specific plant community, it is best to vary the depth of the bottom stratum. This will increase the likelihood of success for a more diverse targeted plant community and desired functions.

III. Components of a Typical Mitigation Plan

Compensatory mitigation is required to offset impacts that cannot be avoided and minimized to the extent practicable. DA personnel must assess the likelihood of success of a mitigation proposal. Success is generally defined as: a healthy sustainable wetland/water that – to the extent practicable – compensates for the lost functions of the impacted water in an appropriate landscape/watershed position. The following information provides a basic framework that will improve predictability and consistency in the development of mitigation plans for permit applicants. Although every mitigation plan may not need to include each specific item, applicants should address as many as possible and indicate, when appropriate, why a particular item was not included (For example, permit applicants who will be using a mitigation bank would not be expected to include detailed information regarding the proposed mitigation bank site since that information is included in the bank's enabling instrument).

1. Mitigation Goals and Objectives

Impact Site

a. Describe and quantify the aquatic resource type and functions that will be impacted at the proposed impact site. Include temporary and permanent impacts to the aquatic environment.

b. Describe aquatic resource concerns in the watershed (e.g. flooding, water quality, habitat) and how the impact site contributes to overall watershed/regional functions. Identify watershed or other regional plans that describe aquatic resource objectives.

Mitigation Site

c. Describe and quantify the aquatic resource type and functions for which the mitigation project is intended to compensate.

d. Describe the contribution to overall watershed/regional functions that the mitigation site(s) is intended to provide.

2. Baseline Information - for proposed impact site, proposed mitigation site & if applicable, proposed reference site(s).

a. Location

1. Coordinates & written location description.
2. Maps (e.g., site map with delineation, map of vicinity, map identifying location within the watershed, USGS map, NWI map, NRCS soils map, zoning or planning maps; indicate area of proposed fill on site map).
3. Aerial/Satellite photos.

b. Classification – Such as Hydrogeomorphic, Cowardin, Rosgen stream type, NRCS classification, etc, as appropriate.

c. Quantify wetland resources (acreage) or stream resources (linear feet) by type(s).

d. Assessment method(s) used to quantify impacts to aquatic resource functions (e.g., HGM, IBI, WRAP, etc.); explain findings. The same method should be used at both impact and mitigation sites.

e. Existing hydrology

1. Water source(s) (precipitation, surface runoff, groundwater, stream)
2. Hydroperiod (seasonal depth, duration, and timing of inundation and/or saturation), percent open water.
3. Historical hydrology of mitigation site if different than present conditions
4. Watershed drainage area.
5. Results of water quality analyses (e.g., data on surface water, groundwater, and tides for such attributes as pH, redox, nutrients, organic content, suspended matter, DO, heavy metals).

f. Existing vegetation

1. List of species on site, indicating dominants.
2. Species characteristics such as densities, general age and health, and native/non-native/invasive status.
3. Percent vegetative cover; community structure (canopy stratification).
4. Map showing location of plant communities.

g. Existing soils

1. Soil profile description (e.g., soil survey classification and series) and/or stream substrate (locate soil samples on site map).
2. Results of standard soils analyses, including percent organic matter, structure, texture, permeability.

h. Existing wildlife usage (indicate possible threatened and endangered species habitat).
i. Historic and current land use; note prior converted cropland.
j. Current owner(s)
k. Watershed context/surrounding land use.
  1. Impairment status and impairment type (e.g., 303(d) list) of aquatic resources.
  2. Description of watershed land uses (percent ag, forested, wetland, developed).
  3. Size/Width of natural buffers (describe, show on map).
  4. Description of landscape connectivity: proximity and connectivity of existing aquatic resources and natural upland areas (show on map).

5. Relative amount of aquatic resource area that the impact site represents for the watershed and/or region (i.e., by individual type and overall resources).

3. Mitigation Site Selection & Justification

a. Site-specific objectives: Description of mitigation type(s), acreage(s) and proposed compensation ratios.
b. Watershed/regional objectives: Description of how the mitigation project will compensate for the functions identified in the Mitigation Goals section 1(c).
c. Description of how the mitigation project will contribute to aquatic resource functions within the watershed or region (or sustain/protect existing watershed functions) identified in the Mitigation Goals section 1(d). How will the planned mitigation project contribute to landscape connectivity?
d. Likely future adjacent land uses and compatibility (show on map or aerial photo).
e. Description of site selection practicability in terms of cost, existing technology, and logistics.
f. If the proposed mitigation is off-site and/or out-of-kind, explain why on-site or in-kind options are not practicable or environmentally preferable.
g. Existing and proposed mitigation site deed restrictions, easements and rights-of-way. Demonstrate how the existence of any such restriction will be addressed, particularly in the context of incompatible uses.
h. Explanation of how the design is sustainable and self-maintaining. Show by means of a water budget that there is sufficient water available to sustain long-term wetland or stream hydrology. Provide evidence that a legally defensible, adequate and reliable source of water exists.
i. USFWS Listed Species Clearance Letter or Biological Opinion.
j. SHPO Cultural Resource Clearance Letter.

4. Mitigation Work Plan

a. Maps marking boundaries of proposed mitigation types; include coordinates.
b. Timing of mitigation: before, concurrent or after authorized impacts; if mitigation is not in advance or concurrent with impacts, explain why it is not practicable and describe other measures to compensate for the consequences of temporal losses.
c. Grading plan
  1. Indicate existing and proposed elevations and slopes.
  2. Describe plans for establishing appropriate microtopography. Reference wetland(s) can provide design templates.

d. Description of construction methods (e.g., equipment to be used)
e. Construction schedule (expected start and end dates of each construction phase, expected date for as-built plan).

f. Planned hydrology
    1. Source of water.
    2. Connection(s) to existing waters.
    3. Hydroperiod (seasonal depth, duration, and timing of inundation and saturation), percent open water, water velocity.
    4. Potential interaction with groundwater.
    5. Existing monitoring data, if applicable; indicate location of monitoring wells and stream gauges on site map.
    6. Stream or other open water geomorphic features (e.g., riffles, pools, bends, deflectors).
    7. Structures requiring maintenance (show on map) Explain structure maintenance in section 6(c).

g. Planned vegetation
    1. Native plant species composition (e.g., list of acceptable native hydrophytic vegetation).
    2. Source of native plant species (e.g. salvaged from impact site, local source, seed bank) stock type (bare root, potted, seed) and plant age(s)/size(s).
    3. Plant zonation/location map (refer to grading plan to ensure plants will have an acceptable hydrological environment).
    4. Plant spatial structure – quantities/densities, % cover, community structure (e.g., canopy stratification).
    5. Expected natural regeneration from existing seed bank, plantings, and natural recruitment.

h. Planned soils
    1. Soil profile
    2. Source of soils (e.g., existing soil, imported impact site hydric soil), target soil characteristics (organic content, structure, texture, permeability), soil amendments (e.g., organic material or topsoil).
    3. Erosion and soil compaction control measures.

i. Planned habitat features (identify large woody debris, rock mounds, etc. on map).

j. Planned buffer (identify on map).
    1. Evaluation of the buffer's expected contribution to aquatic resource functions.
    2. Physical characteristics (location, dimensions, native plant composition, spatial and vertical structure.

k. Other planned features, such as interpretive signs, trails, fence(s), etc.

5. Performance Standards

a. Identify clear, precise, quantifiable parameters that can be used to evaluate the status of desired functions. These may include hydrological, vegetative, faunal and soil measures. (e.g., plant richness, percent exotic/invasive species, water inundation/saturation levels). Describe how performance standards will be used to verify that objectives identified in 3(b) and 3(c) have been attained.

b. Set target values or ranges for the parameters identified. Ideally, these targets should be set to mimic the trends and eventually approximate the values of a reference wetland(s).

6. Site Protections and Maintenance

a. Long-term legal protection instrument (e.g. conservation easement, deed restriction, transfer of title).

b. Party(ies) responsible and their role (e.g. site owner, easement owner, maintenance implementation). If more than one party, identify primary party.

c. Maintenance plan and schedule (e.g. measures to control predation/grazing of mitigation plantings, temporary irrigation for plant establishment, replacement planting, structure maintenance/repair, etc.).

d. Invasive species control plan (plant and animal).

7. Monitoring Plan

a. Party(ies) responsible for monitoring. If more than one, identify primary party.

b. Data to be collected and reported, how often and for what duration (identify proposed monitoring stations, including transect locations on map).

c. Assessment tools and/or methods to be used for data collection monitoring the progress towards attainment of performance standard targets.

d. Format for reporting monitoring data and assessing mitigation status.

e. Monitoring schedule

8. Adaptive Management Plan

a. Party(ies) responsible for adaptive management.

b. Identification of potential challenges (e.g., flooding, drought, invasive species, seriously degraded site, extensively developed landscape) that pose a risk to project success. Discuss how the design accommodates these challenges.

c. Discussion of potential remedial measures in the event mitigation does not meet performance standards in a timely manner.

d. Description of procedures to allow for modifications of performance standards if mitigation projects are meeting mitigation goals, but in unanticipated ways.

9. Financial Assurances

a. For each of the following, identify party(ies) responsible to establish and manage the financial assurance, the specific type of financial instrument, the method used to estimate assurance amount, the date of establishment, and the release and forfeiture conditions:

1. Construction phase
2. Maintenance
3. Monitoring
4. Remedial measures
5. Project success

b. Types of assurances (e.g., performance bonds, irrevocable trusts, escrow accounts, casualty insurance, letters of credit, etc.).

c. Schedule by which financial assurance will be reviewed and adjusted to reflect current economic factors.

IV. Success Criteria

The success criteria are used to determine if the compensatory mitigation has met the approved goals and objectives. Once the Corps has verified the final success criteria have been met, applicants may be released from further monitoring or remediation of the compensatory mitigation site. Final success criteria must be based on project goals. Carefully planned wetland and stream projects are designed with the intent of creating specific structural and functional features that support the goals. Appropriate success criteria are the single most important element in the development of successful compensatory mitigation.

Each compensatory mitigation plan shall include project specific final success criteria that are:

A. Based on targeted functions and values of the compensatory mitigation as compared to those identified from an assessment of the aquatic resources impacted at the development site.

B. Realistic, based on the purpose of the compensatory mitigation, design of the site, and functional assessment criteria.

C. Measurable and statistically valid.

D. Achievable by the end of the maintenance and monitoring period.

V. Nashville District Mitigation Checklist

Nashville District project managers will use the following checklist when reviewing proposed compensatory mitigation plans. Specifics on each of these items have been described above in Section III.

- ☐ Mitigation Goals and Objectives
  - o Describe functions lost at impact site
  - o Describe functions to be gained at mitigation site
  - o Describe overall watershed improvements to be gained

- ☐ Baseline Information for Impact and Proposed Mitigation Sites
  - o Provide data on physical attributes of sites (soils, vegetation, hydrology)
  - o Describe historic and existing land uses and resources impacted
  - o Describe reference site attributes if available

- ☐ Mitigation Site Selection and Justification
  - o Describe process of selecting proposed site
  - o Likelihood of success, future land use compatibility, etc.

- Mitigation Work Plan
    - Location
    - Construction Plan
    - Describe planned hydrology, vegetation, soils, buffers, etc.

- Performance Standards
    - Identify success criteria
    - Compare functions lost and gained at impact and mitigation sites
    - Describe soils, vegetation and hydrology parameter changes

- Site Protection and Maintenance
    - List parties and responsibilities
    - Provide evidence of legal protective measures
    - Maintenance plan and schedule

- Monitoring Plan
    - Provide monitoring schedule, identify party (ies) and responsibilities
    - Specify data to be collected, including assessment tools and methodologies

- Adaptive Management Plan
    - Identify party (ies) and responsibilities
    - Remedial measures (financial assurances, management plan, etc.)

- Financial Assurances
    - Identify party (ies) responsible for assurances
    - Specify type of assurance, contents and schedule

VI. Additional Information

For further information about preparing compensatory mitigation plans or the Nashville District USACE regulatory program, contact the Regulatory Branch at: U.S. Army Corps of Engineers; Regulatory Branch, CELRN-OP-F; 3701 Bell Road; Nashville, Tennessee 37214-2660, or telephone (615) 369-7500. On the Internet, visit the Nashville District's Regulatory Branch homepage at *http://www.lrn.usace.army.mil/cof/* and the national Regulatory Program homepage at *http://www.usace.army.mil/inet/functions/cw/cecwo/reg/.*